CLAIMS

What is claimed is:

1. A magnetic head having an air bearing surface (ABS), comprising:

a free layer; and

an antiparallel (AP) pinned layer structure spaced apart from the free layer, the AP pinned layer structure including at least two AP-pinned layers having magnetic moments that are self-pinned antiparallel to each other, the AP-pinned layers being separated by an AP coupling layer;

wherein an easy axis of a first of the AP-pinned layers is oriented at an angle of at least 5° from the ABS along a plane of the first AP-pinned layer.

2. A head as recited in claim 1, wherein an easy axis of each of the AP-pinned layers is oriented at an angle of at least 5° from the ABS along a plane of the associated AP-pinned layer.

3. A head as recited in claim 1, wherein the easy axis of the first AP-pinned layers is oriented at an angle of between about 30° and about 60° from the ABS along a plane of the first AP-pinned layer.

4. A head as recited in claim 1, wherein the easy axis of the first AP-pinned layer is oriented at an angle of between about 40° and about 50° from the ABS along a plane of the first AP-pinned layer.

5. A head as recited in claim 1, wherein easy axes of the AP pinned layers are oriented at about the same angle.

6. A head as recited in claim 1, wherein easy axes of the AP pinned layers are oriented at different angles.

7. A head as recited in claim 1, wherein the easy axis is set by forming the first AP-pinned layer in the presence of an applied magnetic field having flux oriented at an angle of at least 5° from the ABS along the plane of the first AP-pinned layer.

8. A head as recited in claim 1, wherein the AP pinned layer structure is self pinned, the AP pinned layer structure not being stabilized by an antiferromagnet.

9. A head as recited in claim 1, wherein the magnetizations of the AP-pinned layers are oriented perpendicular to the ABS.

10. A head as recited in claim 1, further comprising an AFM layer.

11. A head as recited in claim 11, wherein the easy axis of the first AP-pinned layer is oriented at an angle of between about 5° and about 45° from the ABS along a plane of the first AP-pinned layer.

12. A head as recited in claim 1, wherein the head is a CPP GMR sensor.

13. A head as recited in claim 1, wherein the head is a CPP tunnel valve sensor.

14. A head as recited in claim 1, wherein the head is a CIP sensor.

15. A magnetic head having an air bearing surface (ABS), comprising:

a free layer; and

an antiparallel (AP) pinned layer structure spaced apart from the free layer, the AP pinned layer structure including at least two AP-pinned layers having magnetic moments that are self-pinned antiparallel to each other, the AP-pinned layers being separated by an AP coupling layer;

wherein the easy axes of the AP-pinned layers are oriented at an angle of between about 30° and about 60° from the ABS along a plane of the associated AP-pinned layer.

16. A head as recited in claim 15, wherein the easy axis of each of the AP-pinned layers is oriented at an angle of between about 40° and about 50° from the ABS along a plane of the associated AP-pinned layer.

17. A head as recited in claim 15, wherein the angle of each of the easy axes is about the same.

18. A head as recited in claim 15, wherein the angles of the easy axes are different.

19. A head as recited in claim 15, wherein the easy axis is set by forming the AP-pinned layers in the presence of an applied magnetic field having flux oriented at an angle of between about 30° and about 60° from the ABS along the plane of the first AP-pinned layer.

20. A head as recited in claim 15, wherein the AP pinned layer structure is self pinned, the AP pinned layer structure not being stabilized by an antiferromagnet.

21. A head as recited in claim 15, wherein the magnetizations of the AP-pinned layers are oriented perpendicular to the ABS.

22. A head as recited in claim 15, further comprising an AFM layer.

23. A head as recited in claim 22, wherein the easy axis of the first AP-pinned layer is oriented at an angle of between about 5° and about 45° from the ABS along a plane of the first AP-pinned layer.

24. A head as recited in claim 15, wherein the head is a CPP GMR sensor.

25. A head as recited in claim 15, wherein the head is a CPP tunnel valve sensor.

26. A head as recited in claim 15, wherein the head is a CIP sensor.

27. A magnetic storage system, comprising:

magnetic media;

at least one head for reading from and writing to the magnetic media, each head having:

a free layer; and

an antiparallel (AP) pinned layer structure spaced apart from the free layer, the AP pinned layer structure including at least two AP-pinned layers having magnetic moments that are self-pinned antiparallel to each other, the AP-pinned layers being separated by an AP coupling layer;

wherein an easy axis of a first of the AP-pinned layers is oriented at an angle of at least 5° from the ABS along a plane of the first AP-pinned layer;

a slider for supporting the head; and

a control unit coupled to the head for controlling operation of the head.